TECHNICAL SPECIFICATIONS

- **Detailed technical specifications shall be as per the Schedule of Rates of CSR 2021-22 and PWD SR 2018-19. The items which are not covered under this shall be referred in National Building Code (NBC).**
- **Technical specifications for some item of works are detailed below for ready reference.**

SECTION – I

EARTH WORK

1.0 INDIAN STANDARD

Work shall be carried out to Indian Standards and Code of Practices, in absence International Standards shall be followed. These shall be latest issue. List given hereunder is not to be considered as conclusive and is for reference and guidance only. Any discrepancies/conflict noticed shall be directed to the officer incharge for his direction /approval. However as a general rule more stringent specification shall take precedence.

(1) IS 1200 Method of measurement of Building and Civil Engineering works.

(2) IS 1498 Classification and Identification of soils for general engineering purpose

(3) IS 2720 Method of test of soil

(4) IS 3764 Safety code for excavation work

(5) IS 4081 Safety code for blasting and related drilling operation

(6) IS 6313 Part 1 Code of practice for anti termite measures in buildings:
Constructional measures.
Part 2 Code of practice for anti termite measures in buildings:
Pre constructional chemical treatment measures

(7) SP 27 Hand book of method of measurement of building works

(8) Explosive Rule 1940

2.0 SITE CLEARANCE

2.1 Prior to the start of any activity of earthwork, the area under construction shall be cleared of shrubs, vegetation, grass, brushwood, trees and saplings of girth upto 30 cm measured at a height of 1 metre above ground level. All rubbish must be removed and stacked at a distance of 50m outside the periphery of the area under clearances or location as decided by the officer Incharge

2.2 The rate of such clearance is to be included in the rate of other earthwork items and no separate rate shall be paid.

3.0 SETTING OUT

3.1 The contractor shall prepare detailed setting out drawings based on the layout of Architectural drawings and those shall be submitted to the Incharge prior to commencement of work. Bench Marks and Reference Lines shall be established, by the contractor with approval of the Incharge

3.2 The contractor shall do the setting out with the use of theodolite and like instruments at site, based on details given to him. He shall erect timber profiles, masonry pillars, burjis, etc. for his use. All markings on these shall be painted with red colour and they shall be maintained for the entire duration of the project. Setting out shall be approved by the Incharge before the commencement of any work.

3.3 The rate for the earthwork items shall include expenses for all such work including labour, material and equipment/ instruments, etc. No additional payment shall be eligible on this account.

4 EXCAVATION IN SOILS

- Excavation over area

Excavation exceeding 1 m in width as well as 10 sq m in plan and 30 cm in depth shall be considered as excavation over area.

4.1 Surface dressing

Trimming of natural ground, excavated surfaces, and filled up areas to remove vegetation and/or small inequalities not exceeding 15 cm in depth shall be described as surface dressing.

Rough excavation

4.1 Excavation not requiring dressing of sides and bottom and reduction to exact levels, such as winning earth from borrow pits, hill side cuttings,

2 etc. shall be described as rough excavation.

Surface excavation

Excavation exceeding 1 m in width as well as 10 sq m on plan but not exceeding 30 cm in depth shall be considered as surface excavation.

4 Trenches for pipes/cables

4.3 It shall be detailed with nominal dia of pipe/cable. Required bottom width, allowance for concrete foundation for laying pipes, working area, grip required for socketed pipe, return fill, ramming and removal of surplus soil shall be part of this item unless otherwise specified. It shall generally be measured in cubic metres unless specified specifically as running meter in the BOQ.

4.4 Post holes

Independent post holes (or similar holes) each not exceeding 0.5cum shall generally be enumerated. Rate shall include return fill, ramming and removal of surplus soil. Howeverthis shall be in cubic meters as part of excavation items.

4 General

4.5 The excavated earth, shall be thrown or disposed off beyond 50 m periphery of the building. Earth suitable for backfilling shall be stacked separately.

Subsequent disposal of the surplus and unsuitable material shall be as per the respective items. Foundations, trenches shall be dug out to the exact dimensions as shown in the drawings or as directed by the Incharge

4.6 In firm soil, the sides of the trench shall be kept vertical upto a depth of 2 m. If the trench is to be deeper, it shall be in the form of steps of 50 cm, at every 2m depth. This shall be suitably increased or decreased as per site conditions and type of soil met with. This shall be to the approval of the Incharge. Sloping of sides also may be adopted.

4.7

4.7.1 The bed of trenches shall be firmly consolidated and leveled by watering and ramming of the soft soil. Defective spots shall be dug out and filled with concrete of the same mix as of PCC or as directed by the Incharge. Cost of digging and filling with concrete shall be paid extra if

excavation and PCC is measured separately.

4.7.2 If excavation is done to a depth greater than that required, excess depth shall be back filled with the same mix as of PCC or as directed. Cost of such concrete shall be to the contractor's account.

4.7.3 Excavated trenches shall have to be approved by the INCHARGE prior to laying of PCC or any other Permanent Work.

4.74

4.7.5 Excavation for drains shall be carried out with extra care to cut the sides and bottom exactly to the required shape, slope and gradient.

4.7.6 Filling for excess deeper excavation shall be done at the contractor's cost in consultation with the Incharge Excavated materials shall not be placed within 1 m of the edge of the trench or half the depth of the trench, whichever is more.

4.7.7 Excavations for column footings shall be carried to depths indicated in the drawings. Safe bearing capacity at such depth shall be verified to comply design requirements. If ordered by the Incharge, appropriate tests shall be carried out by the contractor.

Protection

4.8 Fencing and/or other suitable measures for protection against risk of accidents due to open excavation shall be provided by the contractor at his cost.

4.8.1 Where excavation is to be carried out below the foundation level of an adjacent structure, and to avoid underpinning, precautions such as shoring and strutting, etc. must be taken. No excavation should start till such measures are taken to the satisfaction of the Incharge.

4.8.2 Payments for such work shall not be made separately unless specified otherwise.

EXCAVATION IN SOFT ROCK

This shall be carried out by crowbars, pickaxes or pneumatic drills or

5.0 any other suitable means. Blasting may be permitted if the contractor so desires but no extra money shall be paid for blasting. Measurements

5.1 shall be in cubic meter.

Other general details same as clause 4.7. and its sub clauses.

5.2

EXCAVATION IN HARD ROCK

6.0 General

On meeting hard rock that requires blasting, the contractor shall

6.1 inform the Incharge On approval in writing, blasting operation shall start if the contractor feels it necessary and so desires.

6.1.

1 The contractor shall obtain the necessary license from the District Authorities for undertaking blasting work and explosive storing as per Explosives Rules 1940, and as updated. Explosives shall only be procured from an authorised dealer. He shall be responsible for the safe custody and proper accounting of explosives. The Incharge shall

6.1. have access to the store.

2

The contractor shall be responsible for any accident to those working on the site, to the public or to property due to blasting operations.

Measurements shall be in cubic meter by stacking rock and applying

6.1. predetermined deduction for voids.

3

Precautions

Safety measures to be adhered to shall be as detailed in IS 4081, Safety

6.1. Code of Blasting (as amended from time to time, and to related drilling

4 operations). Also digest No.37 of C.R.R.I and I.R.C.A. Road tariff No.18 shall be adhered to.

6.2

Blasting operation shall be carried out under the supervision of a

6.2. responsible authorised agent of the contractor. Timings shall be as approved by the Incharge in writing. Lunch break will be preferred.

1 The authorised agent of the contractor should be well conversant with the rules and regulations of blasting operations. Further the contractor shall employ licensed blasters for actual operation.

6.2.

2

6.2.3 All proper precautions for safety shall be taken. All persons shall be moved away to a distance not less than 200 m. All entries shall be sealed and red flags displayed at prominent places.

6.2.4 Blasting shall be done only with gunpowder. Dynamite, gelignite, or any other high explosive shall be used only with written permission of the Incharge.

6.2.5 The number of charges to be fired and the actual number of shots heard shall be counted and the contractor's agent shall satisfy himself by examining that all charges have exploded. Only then shall workmen be allowed to start work. Unexploded charges shall be flooded with water, a new hole drilled and exploded again.

The Incharge shall be informed about all misfires, their causes and the remedial steps taken.

6.2.6 **CLASSIFICATION**

All soils comprising any of the following :

7.0 (a) (a) Vegetable or organic soil, turf, sand, silt, loam, clay, mud, peat, black cotton soil, soft shale or loose murrum.

7.1 (b) Any mixture of soils in (a).

(c) Mud concrete below ground level.

(d) Generally any material which yields to the ordinary application of a pickax and shovel or to phawra, rake or other ordinary digging implement and notaffording resistance to digging greater than mentioned in (a) to (c).Stiff heavy clay, hard shale, or compacted murrum requiring close application of a grafting tool or pick or both and shovel.

(f) Gravel and cobblestone (cobblestone is a rock fragment), usually rounded, having maximum dia in one direction of 75-300 mm.

Soft rock comprising any of the following

(a) Soling of roads, paths, etc. and hard core.

7.2 (b) Macadam surfaces of any description (water bound, grouted, tarmac, etc.)

(c) Lime concrete, stone masonry, in lime mortar and brick work in lime or

cement mortar, below ground level.

(d) Soft conglomerate, where the stones may be detached from the matrix with picks, crow bars, wedges, etc.

(e) Limestone, sandstone, laterite, hard conglomerate or other soft or disintegrated rock which may be quarried or split with a crowbar.

(f) Unreinforced cement concrete which may be broken up with crowbars or pickaxes and stone masonry in cement mortar, below ground level.

(g) Boulders not requiring blasting, rock fragments usually rounded by weathering, disintegration and exfoliation or abrasion by water or ice, having maximum dia length in any direction of 500 mm, found loose, embedded, etc.

(h) Other varieties of rock which would normally be removed with pick, crowbars, wedges and hammer with only a little difficulty.

7.3 **Hard rock comprising any of the following**

(a) Any rock or cement concrete in excavation for which the use of mechanical equipment or blasting is required.

(b) Reinforced cement concrete.
(c) Boulders bigger than 1/2 cubic meter requiring blasting.

(d) Hard rock as in (a) to (c) requiring blasting but prohibited from doing so for any reason and excavation has to be carried out by chiseling, wedging or any other agreed method.

8.0 FILLING

8.1 Filling shall be done where required with approved quality of earth. It may be from excavation and, where possible, cutting and filling shall be done simultaneously to avoid double handling.

8.2 Filling shall be done in layers not exceeding 15 cm in depth. Earth used shall be free from roots, grass and rubbish and all lumps and clods exceeding 8 cm in any direction shall be broken down. Each layer shall be watered with optimum moisture content to achieve 95% Procter density. Consolidation shall be done by mechanical roller of minimum 12 tonnes weight. The roller shall pass a minimum of 10 runs evenly to

8.3 achieve dense consolidation. All undulation made up and final layer re-

8.4 rolled.

Measurement shall be for compacted volume in Cubic Meter.

Sand filling

The sand shall be free from any organic and deleterious materials as detailed in IS. It should be suitable for compaction. Filling shall be in layers of 15 to 20 cm watered with optimum moisture content and mechanical rammers.

Measurement shall be for compacted volume in Cubic Meter.

Rubble soling

Good quality 150 mm to 230 mm thick rubble soling shall be carried out depending upon the grade of soil. Rubble used shall be at least 100 mm for 150 mm thick soling and 150 mm for 230 mm thick soling. Stone shall be hand packed as close as possible and bedded firmly with the broadest face downwards and the greatest length across, voids filled with chips and small stones. These shall be hammered down to achieve packing and the complete filling of interstices. To achieve the desired levels and slopes, pegs at suitable intervals (about 12m) shall be fixed.

9.0 Soling shall be watered and again packed with sand or murrum to fill interstice's created by watering. Then it shall be rolled with 10 (on roller or vibratory compactor. Filling sand or murrum, watering and rolling shall continue till full compactness is achieved to satisfaction of the Incharge.

Measurement shall be in Square Meter.

10.0 PLANKING AND STRUTTING

10.1 In case of deep trenches where the soil is soft and not capable of being retained without the help of support, planking and strutting as required shall be carried out. It shall be the responsibility of the contractor to take steps to prevent slide/collapse. Method of planking/strutting will be largely influenced by the type of soil encountered and as approved by the Incharge.

DISPOSAL OF SURPLUS EARTH

Surplus earth shall be used to the maximum extent in the compound. Earth useful for filling shall be separately stacked as directed by the Incharge from time to time.

10.2 Approved quality earth shall be used in the filling. It shall be consolidated as detailed and approved by the Incharge.

10.3 Rate for excavation shall include sorting out of useful materials.

10.4 All surplus and unusable earth shall be disposed off outside the plot but at a location approved by local authority and conforming to their specification. The contractor shall quote his rate for disposing off or carting away the items considering requirements and standards of the local authority with whose permission surplus and unusable earth shall have to be disposed off.

11.0 DEWATERING

Bailing or pumping out of water that may have accumulated due to rains, subsoil seepage, or any other means shall be carried on continuously and the area shall be kept dry for the following operations:

(a) Measurements
(b) Concreting or masonry work
(c) Shuttering and reinforcement
(d) Backfilling
(e) Line out
(f) Any other reason deemed fit by the In charge.

12.0 MEASUREMENT

12.1 The following shall not be measured separately and allowance for the same shall be deemed to have been made in description of the main item.

(a) (a) Setting out works, erecting profiles, etc,

(b) Site clearance such as clearing of shrubs, brushwood, small trees not exceeding 30 cm in girth measured at one meter above ground.

(c) Unauthorised battering or benching of excavations.

(d) Forming (or leaving) DEAD MEN or TELL-TALES in borrow pits and their removal after measurements.

(e) Forming or leaving steps in the sides of deep excavations and their removal after measurements.

(f) Excavations for insertion of planking and strutting.

(g) Removing slips or falls in excavations.

(h) Dewatering by bailing or pumping out of water in excavations from rains, sub-soil water, tides, undercurrents, etc.

(i) Slinging or supporting pipes, electric cables, etc. met during excavation or while carrying out any other item of work.

(j) Dressing, trimming of sides, leveling, or grading and ramming of bottoms.

Soo(i)Soils, soft rocks, hard rocks shall be measured as per SP 27 Part I 12.2 except for the followings:

(a) Filling shall be in cubic meter for consolidated volume. The lift shall be considered from made-up ground level.

(b) (b) Planking and strutting required to be left in position shall be measured separately. Incharge's permission in writing shall have to be obtained for this. In no other case shall payment be made for planking and strutting, if carried out.

(c) (c) Lead and lifts shall be as per the BOQ.

SECTION-II A

CONCRETE WORK

GENERAL

1.1 Standard

Work shall be carried out to Indian Standards and Code of Practices, in absence International Standards shall be followed. These shall be latest issue. List given hereunder is not to be considered as conclusive and is for reference and guidance only. Any discrepancies /conflict noticed shall be directed to the Incharge for his direction / approval. However as a general rule more stringent specification shall take precedence.

Specification for Ordinary and low heat, portland cement Specification for 43 grade ordinary portland cement Specification for 53 grade ordinary portland cement

(1)	IS 269	Specification for Ordinary and low heat, Portland cement
(2)	IS 8112	Specification for 43 grade ordinary Portland cement
(3)	IS 12269	Specification for 53 grade ordinary Portland cement
(4)	IS 383	Specification for Coarse and fine aggregates from natural sources for concrete
(5)	IS 456	Code of practice for plain and reinforced concrete
(6)	IS 460	Specification for test sieves (Part I, II & III)
	i)	Wire cloth test sieve
	ii)	Perforated plate test sieve
	ii)	Method of examination of test sieves
(7)	IS 515	Specification for natural and manufactured aggregates from natural sources for concrete.
(8)	IS 516	Method of test for strength of concrete
(9)	IS 875 (Part I, II & III)	Design loads for building structure.
(10)	IS 1199	Method of Sampling and analysis of concrete
(11)	IS 1791	Batch type concrete mixers.
(12)	IS 1893	Earthquake resistant design.
(13)	IS 2386	Method of test for aggregate for concrete (Part I, II & III)
	i)	Particle size and shape
	ii)	Estimation of deleterious materials and organic impurities
	iii)	Specific gravity, density, voids, absorption and bulking.
(14)	IS 2505	General requirements for concrete vibrators.
(15)	IS 2645	Specification for Integral cement water proofing compound.
(16)	IS 3025	Method of Sampling and test (Physical and Chemical for water)
(17)	IS 4326	Code of practice for earthquake resistant design and construction of building.
(18)	IS 4926	Specification for ready mixed concrete.
(19)	IS 7861	Code of practice for extreme weather concreting
	i)	Recommended practice for cold weather concreting
	ii)	Recommended practice for cold weather concreting
(20)	IS 9103	Specification for admixture for concrete
(21)	IS 12118	(Part I) Specification for two parts polysulphide based sealant: general requirements
(22)	SP 23	Hnadbook on concrete mix
(23)	SP 24	Explanatory handbook on Indian Standards code for plain and reinforced concrete (IS 456)
(24)	SP 27	Handbook of method of measurement of building works.

1.2 Quality Assurance

1.2.1 Concrete used on site shall comply to relevant parts of Standards, Codes of practices,

technical specification given in particular or approved, designed mixes as prepared, approved and adopted for works to give designed strength, serviceability, long term durability etc.

1.2.2

1.2.3

1.2.4

Provide and monitor quality control over materials received from suppliers / manufacturers to ensure that materials comply with standard specified and are as approved.

1.2.5

Provide experienced supervision and work force to ensure that workmanship is of specified quality.

1.3

1.3.1

Work shall not be subjected to harmful, dangerous, damaging or deleterious exposures while it is in progress or on completion during contract period.

Contractor to undertake quality assurance by documenting.

- Test report for material used in producing concrete.
- Mix design details with laboratory test report, actual site trial mix test and accepted modified design if any
- Pour cards with approval of the

Incharge prior to placement

- Control charts
- Nonconformance reports, changes, orders etc.

Submittals

Submit samples of all materials such as cement, sand, aggregate, admixtures, water etc to be incorporated into concrete along with test certificates from recognized laboratories for the Incharge's approval.

1.3.2 Samples

1.3.3 During construction, the materials shall be sampled and tested as often as directed by the Incharge to the contractor. Samples shall be taken and tested in accordance with latest revisions of Indian standard specifications and the cost thereof shall be borne by the Contractor.

1.4.0 Shop Drawings

Contractor shall prepare and submit method, mode of casting of slabs, beams with details of construction and expansion joint for approval of the Incharge.

2.0

2.1 Examination of conditions
Contractor shall inspect and

examine sub strata and confirm prior to start that.

2.2

- Substrate is acceptable and approved by Incharge

2.2.1

- Conditions are satisfactory

- Setting out/Layout is verified

2.2.2

- Corrective measures needed if any are within reach and contractor proceeds with full responsibility for work.

MATERIALS

Cement

2.2.3

Cement shall be ordinary Portland Cement conforming to IS and shall be of grade 53/43 for structural use or as specified in drawing.

It shall be received in bags of 50 kg or loose in tankers and each batch shall be accompanied with a test certificate of the factory. Also it shall be tested before use to ascertain its strength, setting time, etc. In case cement has been stored for over 3 months or for any reasons the stored cement shows signs of deterioration or contamination, it shall be tested as per the direction of the Incharge prior to use in

the works.

Coarse aggregate

Coarse aggregate shall be obtained from natural sources such as stone, gravel, etc., crushed or uncrushed or a combination thereof from approved quarries. Aggregate shall be hard, strong, dense, durable, clean and free from veins andadherent coatings. It shall be free from soft, feeble, thin, elongated or laminated pieces and shall be roughly cubical in shape. It shall consist of coarse material, most of which is retained on 4.75 mm IS sieve.

Coarse aggregate shall not contain any harmful material such as iron, pyrites, coal, mica, shale or similar laminated material; neither shall it contain clay, alkali, soft fragments, sea shells, organic impurities, etc. in such quantities that adversely affects the strength and durability of the concrete. In addition to the above, in reinforced concrete the aggregate shall not contain any material which might attack the reinforcement. The maximum quantities of

deleterious materials in the coarse aggregate, when determined in accordance with IS 2386 Part I and Part II "Method of test for aggregates for concrete" shall not exceed the limits laid down in table 1 of IS 383.

Aggregate crushing value, impact value, abrasion value and soundness of aggregate shall respectively be in accordance with para 3.3, 3.4, 3.5 and 3.6 of IS 383.

2.2.4 Grading of coarse aggregate shall be in conformity with the requirements laid down

2.2.5 in IS 383. See table 2 and table 3.

2.2.6 The grading of coarse aggregate shall be such that not more than 5% shall be

2.2.7 larger than the maximum size and not more than 10% shall be smaller than the smallest size. Between these sizes the coarse aggregates

2.2.8 shall be well graded.

For heavily reinforced concrete the aggregate shall be subjected to tests in

accordance with IS 2386 or and directed by the Incharge.

The maximum size of coarse aggregate should not be greater than one fourth of the minimum thickness of the member and it should be restricted to 5 mm less than the minimum clear distance between the main bars or 5 mm less than the minimum cover to the reinforcement.

Source of aggregate shall be from an approved Government location. It shall be tested prior to the approval of the Incharge from an approved testing laboratory. In case available aggregates do not meet certain requirements of IS 383 or any other specification, required processing shall be carried out by the contractor at his cost. No extra cost towards these processes, treatment or combination of both shall be paid. It shall be the duty

of the contractor to make sure that aggregate material received by him is from Government approved quarries and with fully paid royalties, taxes, duties, etc. as may be in force from time to time for respective locations.

Coarse aggregate shall have a minimum specific gravity of 2.6. (Saturated surface dry basis). Aggregate below this specific gravity shall not be used without the special permission of the Incharge.

Once a specific source of supply of coarse aggregate is approved, the source shall not be changed without the prior approval of the Incharge.

Fine aggregate

Natural sand deposited by stream or glacial agencies as a result of disintegration of rock shall be used as fine aggregate. Fine aggregate shall pass through 4.75mm

sieve in total. Crushed sand may be added to natural sand in approved proportions to achieve required grading. The fine aggregate (coarse sand FM above 2.25 & Fine sand F M more than 1.25) shall conform to following standards.

(i) For plain and reinforced concrete IS 383 Specification for coarseand fine aggregates from natural sources for concrete.

(ii)Mortar and groutIS 2116 Specification for sand for masonry mortars.

Sand shall be hard, durable, clean and free from adherent coatings and organic matter and shall not contain any appreciable amount of clay. Sand shall not contain harmful impurities such as iron, pyrites, coal particles, lignite, mica shale or similar laminated material, alkali, and organic impurities in

such form or quantities as to affect the strength or durability of concrete or mortar. Also it should not contain any material liable to attack the steel reinforcement.

When tested as per IS 2386 Part I and Part II, fine aggregate shall not exceed permissible quantities of deleterious materials as given in table 1 of IS 383.

Fine aggregate shall be thoroughly washed at site with clean fresh water such that the percentage of all deleterious material is within the permissible limits laid down.

2.2.9 Grading of fine aggregate shall conform to IS and shall fall within limits of one of the four zones given in table 4 of IS 383.

2.3.0 Due allowance for bulking due to damp and moist sand shall be made while preparing the mixes based

2.4

2.4.1 on volume measurements. It shall be determined as per IS 2386 Part III Appendix A.

Water

2.4.2 Water used for mixing and curing shall be clean, reasonably clear and free from objectionable quantities of silt, oils, alkalies, acids, salts so as not to weaken mortar, or concrete or cause

2.4.3 efflorescence or attack the steel in RCC while curing. It

2.4.4 shall be free of elements,

2.4.5 which significantly affects the hydration reaction or otherwise interferes with hardening of concrete during curing or those elements

2.5 which produce

2.5.1 objectionable stains or deposits. Potable water is generally satisfactory but it shall be tested prior to use in

2.5.2 the works.

2.5.3 Water tested shall be in accordance with IS 3025. Maximum permissible limits of deleterious materials in

water as given in IS 456.

Suitability of water shall be ascertained by the compressive strength and initial setting time test as specified under:

a) Average 28 days compressive strength of atleast three 15 cm concrete cubes prepared with water proposed to be used shall not be less than 90% of the average strength of three similar concrete cubes prepared with distilled water. Preparation and testing to be in accordance with IS 516. b)The initial setting time of test blocks made with proposed cement and water to be used shall not be less than 30 minutes and shall not differ by $\pm$ 30 minutes from the initial setting time of control test block prepared with the same cement and distilled water. Preparation and testing of block shall be in

accordance with IS 4031.

The PH value of water shall not be less than 6 and more than 9.

Water shall be tested and approved in writing by the Incharge prior to use in the works,

Admixture

These are substances other than cement, aggregate and water and shall be permitted to be used to modify the properties of concrete for single, or a combination of purposes. This shall be used only on the written approval for specific purpose and at the cost of the contractor. Good concrete shall be achieved without the aid of any admixtures.

Admixtures shall be free from chlorides and sulphates which might affect concrete or any other material which may cause problems to the concrete in the due course of

time. Also it shall have no effect on the reinforcement in case of Reinforced Cement Concrete.

Admixtures generally in use are classified as under:

a) Accelerators
b) Retarders
c) Workability agents
d) Water repelling agents
e) Air-entraining agents
f) Gas-forming agents
g) Corrosion inhibitor additive

2.5.4 These are manufactured and sold by various companies under brand names. The contractor proposing to use any one of them shall submit to the Incharge technical literature with its chemical composition, purpose of use and method recommended by the manufacturer and what he proposes to follow at site for strict control.

The contractor's proposal shall accompany the followings with his request

to use admixture.

2.6 a)The trade name of the admixture, its source and the manufacturer's

2.6.1 recommended method of use.

2.6.2 b)Typical dosage rates and the possible detrimental effects of under and over-dosage.

2.6.3 c) Whether the admixture

2.6.4 contains chloride in any free form or any other chemical

2.6.5 present as an active ingredient which is a likely cause of corrosion of reinforcement or deterioration of concrete.

d)The average expected air content of freshly mixed concrete containing an admixture which causes air to be entrained when used at the manufacturer's recommended rate of dosage.

Miscellaneous

Integral cement water proofing compound specified for specific use shall conform

to IS 2645.

Bituminous felts for waterproofing and damp proofing course shall conform to IS 1322.

Bituminous compounds for water proofing purposes shall conform to IS 1580. Expansion joint filler

Bituminous impregnated premoulded preformed expansion joint filler board conforming to IS 1838 part (I) specification for preformed filler boards shall be of approved quality and thickness at designated locations.

Polysulphide sealants

1 Expansion, construction or other joints shall be sealed with approved quality polysulphide sealants.

2 One part gun grade polysulphide-based joint sealants shall conform to IS 11433 (Part I). It shall be used with the

approval of the In charge and as per the manufacturer's instructions. Correct primer shall be used at the specified location.

3 Two part polysulphide based sealant gun grade or pouring grade shall conform to IS 12118 (part I). Pouring grade shall be used in horizontal joints. Gun grade shall be used in vertical, inclined and horizontal joints.

4 Specified primer shall be applied prior to the use of sealant. Use of sealantshall be as per instructions of the approved manufacturer.

5 Sealant shall be cured at ambient temperature and humidity when applied as per the approved manufacturer's instruction and received in suitable packs. Each package shall indicate:

- Manufacturer's name and trade mark
- Weight of the components

2.6.6

- Instructions for storage

2.7

- Type and grade of sealants

2.7.1

- Date of manufacture and expiry

2.7.2

- Instructions for use

Water bar

2.7.3

PVC or rubber water bar of type, quality and width shall be used as approved by the Incharge. Water bar shall be continuous and fixed at the indicated locations. Water bar should be welded or Joined with the approved method. All angles and corners shall be purpose-made and shall be joined with the approved method.

2.7.4

Delivery and Storage

3.0

It shall be received in bags of 50 kgs and each batch shall be accompanied with a test certificate of the factory. Reject damp or torn bags.

Cement shall be stored in

3.1 dry and water proof shed so as to prevent deterioration due to moisture, dampness. Bags shall be stacked on rigid water-proof platforms about 15 to 20 cm clear above the floors and 25 to 35 cm clear or away from the surrounding walls. A maximum high stack of 10 bags permitted. Stacks shall be so arranged that the first batches are used first, (FIFO) and that they permit easy access for inspection and handling.

3.1.1

3.1.2

Loose cement received shall be stored in silo's. Silo's shall be equipped to receive cement by pump and manually. Silo's shall be water tight and damp proof to keep cement fresh.

Coarse Aggregates and Fine Aggregates

Aggregate shall be stored in such a way that it does not get mixed with mud, grass, vegetables and other

foreign matter. The best way is to have a hard surface platform made out of concrete, bricks or planks. It should be to the approval of the Incharge.

Water

Water storage tanks shall be such as to prevent any deleterious materials getting mixed with it.

Covered storages

Considering the atmospheric/ weather conditions at site storages, covering shall be arranged to take care of temperature controls at site.

CONCRETE

Concrete is prepared by mixing graded aggregate of stone or along with cement, in a specified proportion. Mixing shall be done by a mechanical mixer. Manual hand mixing shall be permitted in specific cases with the written permission

of the Incharge on account of small quantity or location or any other reason acceptable to the Incharge.

Cement concrete

This shall be classified as plain cement concrete or reinforced cement concrete. Plain cement concrete shall be In leveling course under foundations, floors, copings. etc. and shall include form work as part of the work.

Reinforced cement concrete shall be at all locations and comprises form work. reinforcement and concrete. Payment of reinforced cement concrete may be composite or item wise as specified in the BOQ. In PCC, payment for form work shall not be made.

Concrete shall be classified by its compressive strength at the 28th day. The concrete grades shall be as designated in table 2 of IS

456 "Grade of concrete".

Design.mix

BOQ shall specify various types of concrete aimed to be used in works. It shall be the responsibility of the contractor to carry out design mixes and approval of the same shall be obtained from the Inchargeatleast 35 days in advance from the actual pouring of concrete at site in the permanent works.

1. Mix design of concrete shall be done as per IS 10262 & SP 23,24.

Following basic points shall be finalised.

- Characteristic compressive strength and targeted compressive strength required at design stage.
- Standard deviation factor based on site actual execution

conditions.

- Minimum cement specified in BOQ or as per IS for strength and durability for location where concrete is to be used.
- Water cement ratio permitted by IS.
- Workability to be achieved for better workmanship and good quality concrete
- Admixtures to be used if any
- Aggregates being used are tested to IS383. Include for Alkali reactivity, chloride and sulphate contents independently and combination of cement and water.
- Water being used is tested.

Further the contractor shall ensure that designed mix

meet minimum cement contents as specified in BOQ/drawings and proposed revision to IS 456 along with maximum water cement ratio, to different exposure condition from durability point of view. In addition contractor shall ensure

a) Alkali – reactivity

Aggregates containing material susceptible to attack by alkali's (Na_2O and K_2O) originating from cement or other sources and producing expansive reaction shall not be used.The aggregates source shall be initially tested for alkali reactivity prior to being used in design mix.

3.1.3.1 b) Sulphate and chlorides in concreteHarmful salts coming from the concrete materials such as cement, aggregate, water and admixture, as well as by

3.1.3.2 diffusion from environments shall be limited to following

weight of cement.

3.1.4

- Total chlorides (as Cl) -0.15%
- Total soluble sulphate (as 803) - 4 %

3.1.4.1 Compressive strength

For expected strength of cubes tested on the 28th day, the design mix at preliminary test and work site shall be as per IS 456 - 2000.

Water cement ratio

3.1.4.2 The water-cement ratio shall be between 0.42 to 0.55. Additional water may be permitted only at the discretion of the Structural Engineer. The slump shall depend upon the location and type of work. Higher slump with use of plasticizers shall be permitted.

3.1.4.3

3.1.4.4

Trial mixes

The contractor shall submit, at least 5 weeks in advance, to the Incharge the mix design that he proposes to

use at site. The mix design in addition to points in 3.1.2 shall also give basic details (when tested according to IS 1199 and IS 2386-Part III 1963), as per followings

a) Slump/Workability

b) Bleeding

c) Compacting factor

d) Vee-Bee time

e) Cement required for one cubic meter of concrete

f) Wet and dry density

g) Air contents if applicable

On receipt of this, the Incharge may immediately order to carry out work site test before the final approval. This shall be done with mixer and materials actually being used at site.

This shall give the contractor additional chance to check for himself actual workability and make sure that the mix proposed by him will be fully

satisfactory with regards to slump, segregation, bleeding, water-cement ratio and workability.

6 cubes shall be taken from each of the 3 batches to test the mix. Cubes shall be cast, stored, cured, transported and tested to IS 516. The test may be carried out at site or laboratory as approved by the Incharge.

Trial mixes shall be approved provided that average strength of 3 consecutive cubes is not less than that specified and that one out of three may give a value. less than specified but limited to a maximum of 90% of the specified strength.

In case the trial mix falls below the above criterion, the Incharge shall order fresh trial mixes to be made as before, until the desired strength is arrived at.

This design mix and trial mix hold good so long as the

materials continue to be of the same quality and from the same sources. For any

3.1.5 change, the Incharge may order fresh design mix and

3.1.5.1 trial mixes to be carried out before the same Is used at site.

Mixing of concrete

Machinery and equipments.

a) Batching

Batching shall be done by weigh batchers conforming to IS 2722. A platform scale of capacity 300kg with fraction upto 100gms shall be at site. For water supply to mixture through metering system shall be organised.
Design mix converted to volumetric may be permitted byIncharge. Accordingly suitable size of boxes equivalent to 1 bag of 50kg cement shall be prepared by the contractor.

b) Mixer

Mixers used shall conform to IS. Type Capacity shall be as per size, Extent and

nature of work.

c) Transportation

3.1.5.2 Wheel borrows, cranes, mini dumpers, truck, agitators, belt conveyors, pumps with

3.1.5.3 piping etc. as per requirement depending upon location, size extent and nature of work shall be deployed by the contractor with prior approval of the Incharge.

d) Vibrators

Internal and external vibrators working on electricity, Pneumatic or petrol shall be approved by the Incharge. Vibrators shall conform to IS.

e) All machineries and equipments shall be maintained regularly. Periodic calibration of all machines shall be done and records maintained in a register. As and when requested by the

Incharge same shall be forwarded for his inspection.

At the start of mixing, mixer shall be rinsed/coated by loading with cement, sand, water of the same proportion of batch to be used. Loading the mixer/charging the mixer shall be done mechanically and care to be taken that all material is fully loaded.

The mixer shall be run for a minimum period of 2 minutes after all materials are loaded in full quantity. The concrete produced shall be uniform in colour and consistency. Unless agreed by Incharge the first batch of concrete from mixer shall contain two-third of normal quantity of coarse aggregate.

Transportation

Concrete shall be transported to place of pour as far as possible in most efficiently, conveniently and without loss of concrete

characteristic. Method of transportation shall depend upon the location, size and nature of work. Concrete should be placed within 1.5hours of production i.e. prior to initial set.

Use of admixtures such as air entraining agent, retarders etc. shall be adopted and incorporated into design mix stage.

Concrete shall be kept in agitating state when ambient temperatures are high. This shall increase placing time to 1 % hrs after water is added.

Points to be taken care are

3.1.5.4

- Method adopted do not permit segregation
- Containers used are leak proof
- Containers are well covered during rains, heavy winds
- Concrete does not get contaminated by oil, dirt etc.

Placing

The placing temperature of concrete shall not be more than 34° C. If it is more, the Incharge may order addition of ice or chilled water to the concrete. Also the contractor shall take the following precautions :

a) Mixers and weigh batchers shall be painted with white colour
b) Aggregate storing bins shall not be exposed to the Sun
c) Water shall be sprinkled on aggregates well before concreting to keep the temperature low.
d) Use chilled water for mixing or add flake ice as a proportion of the mixing water.
e) Place concrete at night.
f) Ready mix concrete (RMC)

a) Concrete

Ready mix concrete as approved only shall be used. It shall comply all requirements of concrete. Batching plant, mixture, truck mixture,

pumpetcshall conform to relevant Indian standard. Daily returns

shall be provided showing total volume of each class of concrete

received.

b) Pumping of concrete

3.1.5.5

Stationery or mobile pumps as per requirements shall be

deployed. Concrete shall be continuous to avoid any blockage

within pump. Concrete mix shall be with slump as desired by

pump manufacturer and most desirable at site to pump operator /

3.1.6

supervisor.

Required piping, bends, clamps, chutes etc. shall be well organised

and placed in position prior to start so continuous concrete with

3.1.7

minor changes will keep concrete flowing at predetermined location

in approved manner.

Mix design adopted shall be approved by Incharge and shall

conform all test as detailed in specification.

Pump concrete shall flow quite fast and is placed

with larger

impact on formwork. Hence special precautions at design stage of

formwork shall be taken and staging /scaffolds should be well

restrained in all directions to withstand thrust.

Pumping shall be done with due care and safety. Recommendation

ofpump suppliers shall be followed strictly.

Shrinkage cracks

Concreting shall be avoided in very warm weather. If necessary, it shall be covered with damped hessian within 2 hours of placing of concrete.

3.1.8 To achieve good results the concrete shall be immediately covered with a plastic sheet and not allowed any direct wind contact. This shall eliminate shrinkage cracks.

3.1.9

Laying of concrete

3.1.10

a) Concreting shall commence only after form work is approved,

reinforcement is recorded and permission to proceed with concreting

3.1.11

has been approved in writing from the Incharge.

b) Form work should be clean, free from sawdust, pieces of wood or

anyother foreign material. It should have been treated by form

releasingagent prior to the laying of reinforcement and concrete.

Prior to placing concrete against old concrete, masonry, rock all

loose materials shall be removed and surfaces washed down.

Concrete shall be worked around ties and bond and in open joints.

c) Concrete shall be as gently deposited as is practically possible, in its final position to avoid re-handling and shall be so deposited that segregation of aggregates does not occur. In case of deep trenches and footings, it may be done with the help of a chute. Columns and walls shall be so adjusted in form work so that maximum depth is 1.5 metre unless consented to by the Incharge. Concrete from wheel barrows shall not be dumped away from the face of concrete already in place. It shall be

dumped into the face of concrete already in place. In excavations prevent contamination of earth and concrete without disturbing unsupported sides of excavation. Concrete shall not be placed in water except where specified.

d) Concrete onto a sloping surface shall be discharged by providing a chutewith a baffle and a drop at its end so that the concrete remains on the slope.

e) Columns and walls shall be concreted in one operation to their full height to avoid any horizontal construction joint as far as possible.

f) All slabs, beams, wooden planks, and cat-walks shall be provided clear of reinforcement.

g) Concrete shall be placed in position within 30 minutes from the time it is produced. Concrete shall be laid during normal working hours. Concreting at night or on holidays shall be permitted only on the written approval of the Incharge.

g) Placing in each section shall be a continuous between construction joints.The contractor shall make provision for standby equipment. In case of delay or break down stop ends are to be provided or concrete placed to be removed as per direction of the Incharge.

i) Placing shall not take in open during storms or rains, strong winds. Contractor to organise and provide required protection.

Compaction of concrete

Concrete shall be thoroughly compacted as depositing shall proceed by means of able vibrators. The vibrators shall maintain the entire concrete under treatment in an adequate state of agitation and shall continue during the whole period occupied by placing of concrete. Care shall be taken not to over- vibrate the concrete. While withdrawing needles no holes should be visible in concreting. Compaction shall be completed before the initial setting time. Concrete already set shall not be disturbed by successive vibrations.

It shall be ensured that the needle vibrators are not

applied on reinforcement which may destroy the bond between concrete and reinforcement.

When electric vibrators are in use, the standby petrol vibrator must always be available at the concreting point.

Construction joints

In large pours, it is practically not possible to carry on concreting continuously. Hence construction joints shall be provided. Location of construction joint shall be submitted by the contractor for approval of the Incharge. Such joints shall be kept to a minimum. The joints shall be at places where shear force is nil or minimum and these shall be straightandat right angles to the direction of the main reinforcement.

Stop ends provided shall be with necessary slots for reinforcement bars to pass freely without bending or any other obstruction. Also a trapezoidal fillet nailed on stop board shall be provided to form a regular keyed joint. Joints shall be straight and truly vertical or horizontal.

Before commencement of concrete, adjacent concrete stopper and surfaces shall be chipped and roughened to

expose aggregate, then wire brushed and cleaned. The concrete surface shall be sprayed with water for 24 hours before casting and kept wet until casting.

True horizontal joints shallalso be provided with a keyed joint by inserting planed greased timber.

Prepared joint shall be treated as above prior to the start of fresh concreting.

For vertical joints neat cement slurry shall be applied on the surface just before concreting. For horizontal joints, the surface shall be covered with a layer of mortar about 10 to 15 mm thick composed of cement and sand in the same ratio as the cement and sand in the concrete mix. This layer of cement slurry shall be freshly mixed and applied just before concreting.

Expansion joints

Expansion joints shall be formed and located as detailed in the drawing. Insert sealant to completely fill the joint and finish neat and smooth.

Curing

Curing of concrete is most important. There shall be no compromise on this activity and it is for the contractor to arrange for everything necessary to make sure that the concrete is cured to the complete satisfaction of the Incharge. As said above in clause 3.1.8, after concrete has begun to harden i.e. about 1 to 2 hours after laying,.it shall be protected from quick drying with moist or damped hessian cloth or any other material approved by the Incharge. After 24 hours of laying of the concrete, the surface shall be cured by flooding with water or covering with damp hessian cloth for a period of 7 days to keep it

moist.

3.1.12 For the next 7 days the surface shall be kept wet all the time by sprinkling water continuously.

For membrane curing, details as listed in 12.5 of SP 24 shall be followed.

Finishing

3.1.13 Concrete shall be finished keeping in mind the next

3.1.13.1 operation to be carried out over the surface. For guidance the following points shall be noted but the Incharge shall be consulted prior to start of concreting and his decision in this

3.1.13.2 regard shall be final.

a) Roof slab shall be trowelled even and smooth with a wooden float.

b) The surface that will receive plaster shall be roughened immediately.

c) Surfaces that will be in contact with any masonry work shall be roughened immediately,

d) The surface that will receive mosaic floor or IPS or any other type of tiled work shall be roughened while it is green. Every care shall be taken not to disturb the freshly laid concrete.

e) For dust proof (or hardened) finish, clean the

concrete surface of oil and contamination and apply approved dust proof hardener as per manufacturers instructions.

Inspection and corrective measures

On removal of form work, the surface shall be examined by the Incharge. Till such time, no remedial measures shall be carried out by the contractor. All patching, rectification or chipping shall be done only on the Incharge's instructions. In case of any violation of this rule, the concrete poured stands rejected. The decision of the Incharge in this regard shall be final and binding on all parties.

Sagged, bulged, patched, honeycombed work shall stand to be rejected for surfaces that are exposed, or require fair face finish or decorative textured finish. The Incharge may permit any work found structurally safe and areas of unexposed faces, for repairing. As directed by the Incharge these works shall be retained and the cost of repair shall be at the contractor's account.

Cracks observed shall be brought to the notice of the Incharge who shall examine them. It shall be kept under observation and a record

shall be maintained for a period of 45 days. It shall be shown to (lie Structural Engineer and the following procedure shall be followed :-

a) Cracks not developing further and in the opinion of Structural Engineer not detrimental to the strength of the construction shall be grouted with non-shrinking cement slurry or as directed by the Incharge.

b) Cracks developing further and, in the opinion of the Structural Engineer, detrimental to the strength of construction, shall be tested as per the relevant Indian standard.

c) Based on results of the test, the Incharge in consultation with the Structural Engineer shall order remedial measures or order the contractor to dismantle construction, cart away the debris, replace the construction and carry out all the consequential works thereto.

d) Cost of the above shall be borne by the contractor if the failure was on his part. In case it is due to design

faults, it shall be borne by the employer.

3.1.14 e) The decision of the Incharge in this matter shall be final and binding on all parties. This decision shall not be open for arbitration.

3.1.14.1

3.1.14.2

3.1.14.3 Testing

Quantum of cubes and testing

The minimum frequency of cube casting shall be as follows. Each sample shall consist of 6 cubes.

3.2	Concrete quantity Number of Samples.
3.2.1	Upto 5 cu m in a day : 1
	5 cum to 15 cu m : 2
	15 cum to 30 cu m : 3
3.2.2	30 cu m to 50 cu m : 4
	More than 50 cu m : 4 + one additional per each 50 cum or part thereof

Three cubes shall be tested on the 7th day and other three cubes on the 28th day.

Field Tests

It is the responsibility of the contractor to prepare and get the cubes tested and to provide all the material, labour, moulds, equipment, casting and curing facility, charges for testing, etc.

Further, the contractor shall have to provide and maintain all the equipment and staff at the site throughout to carry out the following tests in a small laboratory or get these tests from approved laboratories without extra cost to the contract.

a) Grading of coarse and fine aggregates

b**)** Silt content of sand

c) Moisture content of coarse and fine aggregates

d) Slump test of concrete

e) Concrete cube test

The contractor shall maintain full records of all above tests in a register. The format of records shall be prepared in consultation with the Incharge and either he or his representative shall have full access to the contractor's laboratory.

The contractor shall include charges for the above work in his rates and no extra whatsoever shall be admissible on this account of designing, testing, maintaining laboratory, etc.

Concreting under special conditions

Work in extreme weather conditions

During hot or cold weather the concreting should be done as per the procedure set out in IS 7861 Part I or IS 7861 Part II or as directed by the Incharge

Underwater concreting

The procedure set out under 13.2 of IS 456 shall be followed or as directed by the Incharge

3.2.3 Concreting in sea water

The procedure set out under 13.3 of IS 456 shall be followed or as directed by the Incharge.

3.2.4 Concreting in aggressive soils and water

Guidelines laid down in 13.4 of IS 456 shall be followed together with the Instructions of the Incharge.

3.3.0 Precast concrete

3.3.1 Precast concrete can be plain or reinforced. It shall meet all requirements and specifications of concrete as stated hereof. Precast concrete shall be done for cellular roof units, drainage or specially designed for specific use taking Into consideration achievements In flexibility, speed and

3.3.2 economy in construction.

Precast concrete units shall be cast in a suitable mould so as to make sure that they are,

a) Easy to lift
b) Easy to transport
c) Excellently finished
d) Handy to erect and Join at site

3.3.3 Units shall be sound and free from cracks or any other defects that would interfere with the proper placing of units or the strength or performance of units or the structure.

3.4.0 Precast units shall be lifted and handled with proper tools from points designated to avoid any cracking or developing of any undue stresses . If required, necessary tools and tackles shall be fabricated by the contractor. Precast units shall be removed from mould within 24 hours or the time allowed by the designer or as approved by the Incharge.

All units that are. in the opinion of the Incharge, cracked and unsafe, shall be removed forthwith and no arbitration on this account shall be applicable.

Units shall be stored and stacked in the precasting yard in a proper manner. The date of casting shall be noted therein and wet curing for 15 days shall be done without

fail. The yard shall have a duly dressed ground and sufficient supports at the required intervals to receive precast units.

Units shall be erected only after 28 days of casting and after the cubes of those days have given the strength specified.

Tolerances in units shall not be more than ±3 mm as approved by the Incharge taking into consideration the purpose and location of use.

Plum Concrete

Stone plums shall be used only when specified. Size of stone plums may be from 150 to 300mm.

Plums shall be hard, double clean and free from soft or loose pieces or deleterious material and should not have sharp corners.

3.5.0

Generally first layer of concrete of specified mix shall be of thickness 2.5 time thickness of maximum size of plums to be used. Plums shall be laid when concrete becomes stiff but top portion is still green. No plums shall be used for concrete laid under water. The thickness of next and successive layers shall be 2 times that of largest plums.

Measurements

1. All works shall be

measured in the decimal system.

a) Dimensions shall be measured to the nearest 0.01 metre except for thickness of slab which shall be measured to the nearest 0.005 metre.

b) Areas shall be worked out to the nearest 0.01 sq m

c) Cubic contents shall be worked out to the nearest 0.01 cum

2. All measurements of cutting shall, unless otherwise stated, be held to include the consequent waste.

3. Cement concrete work shall be classified as under:

a) Concrete cast in-situ : Plain and reinforced

b) Precast concrete : Plain and reinforced

c) Prestressed concrete : Cast in-situ or pre-cast

4. All concrete, except as hereinafter provided, shall be measured in cubic metres.

5. The price of concrete shall include ingredient material, mixing, transporting, hoisting to any height and lowering to any

depth, pouring or laying, consolidating, leaving pockets, holes, and protecting them till the next operation or completion of work, hacking the surface to provide key for further work including cleaning, wetting surface, etc. and preparing construction joints as described in clause 3.1.9. of this section.

6. Concrete processed in a special manner for any specific purpose, such as cooled, heated, water-proofed, acid-proofed, heat-resistant shall be measured separately and as per provision in BOQ.

7. Admixtures shall be used if necessary at the request of the contractor for workability and the price for that shall be deemed to be included in the contractor's quoted price of concrete.

8. No deductions shall be made for:

(a) Ends of dissimilar materials (for example beams, posts, girders, purlins, corbels and steps) upto 500 sq cm in section.

(b) Opening upto 0.1 sq m,

(c) Volume occupied by reinforcement.

(d) Volume occupied by drainage, water pipes, conduits, etc. no

exceeding100 sq cm, each in cross sectional area.

(e) Small voids each not exceeding 40 sq cm in section.

(f) Small moulds, drip moulds, chamfers, splays, rounded or covered angles, beads, grooves and rebates upto 10 cm in depth and width.

9. Expansion joints shall be measured in running metre or sq m as the Case may be. Price shall include required shuttering, special treatment if any, filler and finishing material as detailed in drawing or the BOQ.

10. Water proofing of concrete shall be measured separately as an extra over ordinary concrete stating the quantity of water proofing material in litres or kilograms.

11. Surface treatment shall be measured in square metres stating number Ofcoats and proportioning of water proofing liquid to water.

12. Grouting of holding-down bolts and providing temporary boxing or wedges to form holes shall be enumerated. The mix shall be specified. The price shall include required shuttering, grouting, etc.

13. To keep surface dry while concreting, dewatering due to rains and seepage shall be included in the price of concrete.

SECTION – II B

REINFORCEMENT WORK

1.0 GENERAL

1.1 Standard

Work shall be carried out to Indian Standards and Code o Practices. In absence International Standards shall be followed These shall be latest issue. List given hereunder is not to be considered as conclusive and is for reference and guidance only. Any discrepancies/ conflict noticed shall be directed to the Incharge for his direction/approval. However as a general rule more stringent specification shall take precedence.

1.	IS 226	Specification for steel standard quality.
2.	IS 228	Methods for chemical analysis of steels.
3.	IS 280	Specification for mild steel wire for general engineering purpose.
4.	IS 432	Specification for mild steel and medium tensile steel burn and hard drawn steel wires for concrete requirement.
	Part 1	Mild steel and Medium tensile steel bars.
	Part 2	Hard drawn steel wire.
5.	IS 456	Code of practice for construction and design of

		reinforced concrete.
6.	IS 816	Code of practice for use of metal are welding for general construction in mild steel.
7.	IS 961	Specification for structural steel: high tensile steel bars
8.	IS 1566	Hard drawn steel wire fabric for concrete reinforcement.
9.	IS 1599	Method of Bend test
10.	IS 1642	General requirements for fire protection.
11.	IS 1785	Cold drawn stress relieved wire (part I)
12.	IS 1786	Specification for high strength deformed steel bars and wires for concrete reinforcement.
13.	IS 2751	Code of practice for welding of MS bars.
14.	IS 2502	Code of practice for bending and fixing of bars for concrete reinforcement.
15.	IS 2751	Code of practice for welding of MS Bars.
16.	IS 3696	Safety Code of scaffolds and ladders:
	Part I	Scaffolds
	Part 2	Ladders
17.	IS 4014	Code of practice for steel (Part 1 & 2) tubular scaffolding
18.	IS 4082	Recommendation on stacking

		and storage of construction materials at site.
19.	IS 5525	Recommendation for detailing of reinforcement in RCC work.
20.	IS 9417	Recommendation for welding cold worked steel bars for reinforced concrete construction.
21.	IS 10790	Method of sampling of steel for priestesses and reinforced concrete.

1.2 Quality Assurance

1.2.1 The Contractor shall procure and provide reinforcing steel bars conforming to IS specified and shall comply with all physical chemical and mechanical test. Each type shall be from same

1.2.2 manufacturer.

Steel manufacturers shall conform steel produced conforms IS

1.2.3 requirements for reinforced cement concrete works.

Steel shall not react chemically with ingredient of reinforced

1.2.4 cement concrete which are harmful to strength, durability o reinforced cement concrete.

1.2.5

Unit weights and diameter of rolled steel bars shall conform to

1.2.6 IS.

Provide supervision and work force with minimum 5 (five) years experience to ensure workmanship of specified quality.

Contractor to undertake documenting of

- Test reports for steel brought at site for each lot
  a) Chemical composition from factory

1.3 b) Mechanical

c) Physical

1.3.1
- Barbending schedule for cutting and bending
- Record of laps and anchors / development length

1.3.2 Work shall not be subjected to harmful, dangerous and damaging exposures.

Submittals

1.3.3 Submit for approval of the Incharge all details of Material Product which conforms the specification laid down in documents.

Submittals shall include

- Product data sheet
- Manufacturers certificates
- Test report of laboratories
- Alternative product if any with tabulation for conformation

that alternatives proposed meets / exceeds specification.

Samples

Samples of type materials to be used. Further during construction samples shall be taken and tested by the Contractor as per specification and as directed / instructed by the Incharge. The cost of samples and test shall be borne by the Contractor within quoted prices.

1.3.4 Shop drawings

Contractor shall prepare and submit bar bending schedule based on structural detailed drawing prior to fabrication for approval of the Incharge.

Examination of Conditions

Contractor shall inspect and examine sub strata and confirm prior to start that.

- Substrate is acceptable and approved by Incharge
- Conditions are satisfactory
- Setting out/Layout is verified
- Corrective measures needed if any are within reach and contractor proceeds with full responsibility for work.

1.4

MATERIAL

Reinforcing Bars

2.0

Reinforcement bars used in construction shall be mild steel or medium tensile steel round bars and high strength deformed bars. Steel shall be fresh and new. It shall be free of defects and free of rust, oil, paints, grease, loose mill scale or any other deleterious material undesirable for RCC or prevent adhesion of concrete with reinforcement.

2.1.0

2.1.1

M S Plain

Rolled mild steel and medium tensile steel plain round bars used in concrete shall conform to IS 432 Part I. Steel received shall conform to the following IS with regard to manufacturing and chemical composition.

2.1.2

1. M.S. bar Grade I Steel designation Fe 410-S of IS 226

2. M.S. bar Grade II Steel designation Fe 410-0 of IS 1977

2.1.3

3. Medium Tensile Steel designation Fe 540 Steel bars W HT IS 961

2.1.4

Nominal sizes and tolerances shall be as specified in IS 432 Par I. Physical requirements shall be determined in accordance with IS 1608, read in conjunction with IS 226. For reference o minimum requirements, properties are tabulated in IS 432 Table 1 "Mechanical properties of bars mild steel & tensile stee

2.1.5

2.1.6 bars".

2.1.7 Tor / TMT (Thermo-Mechanically-Treated) Steel

High-strength deformed bars for use as reinforcement in concrete shall be of grade Fe 415, Fe 500 and Fe 550 conforming to IS 1786.

Chemical composition shall conform to IS 1786 when made as a relevant part of IS 228.

Welding of cold work steel bars in reinforcement shall be permitted as per IS 2751 and 9417. (Recommendation for welding cold worked steel bars for RCC).

Nominal sizes, cross sectional areas and their mass shall be as specified in IS 1786, allowing due consideration for tolerances specified therein.

2.1.8 Physical properties

a) It shall satisfy IS 1599 test for bend and rebend test in conjunction with IS 226.

b) Bond requirements shall be deemed to have been satisfied if it meets clause 4.Oof IS 1786.

c) Tensile, proof stress and percent elongation shall be as per table 3 of IS 1786.

Material received at site shall have ISI certification mark. Each bundle or coil containing the bars shall be suitably marked with ISI certification mark. Also bars shall be marked to identify categories. This shall be done as per IS 1387.

2.1.9

In case bars are without ISI certification mark, the manufacturer shall give a certificate stating process of manufacture, chemical composition and mechanical properties

Each certificate shall indicate the number or identification mark of the batch production/ cast to which it applies. Corresponding number or identification mark should be found on the

2.1.10 material.All reinforcement material shall be free from loose mill scale, excessive rust, loose rust, pitting, oil, grease, paint, mud or any foreign deleterious material present on the surface.

2.1.11 Cleaning shall be done to the satisfaction of the Incharge.

Each batch brought at site shall be tested prior to use for respective specification / physical properties. Cost of all such tests shall be borne by the contractor. Material acceptable as

2.2.0 per IS shall be allowed into the works. All rejected material shall be removed from site by the contractor within 3 days of rejection. If the same is not done, the Incharge shall impose a penalty of Rs.500/- per metric ton per day. This will be without any appeal and shall not be subjected to arbitration.

Cover block

Cover blocks shall be of non-corrosive material such as plastic but not wooden or broken bricks or stone. Designed purpose made PVC cover spacers shall be used in the Works. Concrete

2.3.0 cover spacers may be permitted by the Incharge. Such concrete spacers shall be cast from concrete and not cement-mortar.

2.4.0 Strength of these blocks shall be equal to the strength of concrete in use. These should be fully cured prior to use in works.

2.5.0

Binding Wire

Binding wire shall be 16 or 18 gauge annealed wire conforming to IS 280. It shall be free from rust, oil, paint, grease, loose mill scale or any other deleterious material undesirable for the

reinforcement and concrete or which may prevent adhesion o concrete with reinforcement.

Mechanical Splices

Mechanical Splices fabricated out of steel pipes, sheets etc capable of withstanding bending and compression stress equa to 1.25 times of those specified for reinforcing bars shall be used. Supplier of splices should submit details about quality o materials, mechanical test results and method of splicing Required hydraulic press and clipping equipments shall be arranged by the Contractor.

Sa Samples pieces shall be prepared at site and shall be tested for torsion.

Sample pieces results should give value of about 1.5 times than required for reinforcing bars.

3.0 Delivery and Storage

3.1 Reinforcing steel bars each batch should accompany manufacturers certificate. Reinforcement bars received at site shall be loaded and unloaded at site and stored with care such that it does not get bent or damaged. Steel received shall be as far as possible in straight length of 12 M. Steel shall be weighed in presence of representative of the contractor prior to delivery being received by him. Empty and loaded truck loads shall indicate correct quantity.

Reinforcement bars received at site shall be stored on hard concrete platform and clear of the ground with the use o timber sleeper, concrete sleeper or any other means Reinforcement material shall be kept covered by tarpaulins or

plastic to avoid excessive corrosion and other contamination Each dia of bars shall be stacked separately. Bars without "ISI' Tor marking shall not be brought to site.

SCOPE OF WORK

The contractor shall be responsible for

Material Procurement

a) The contractor will submit the Schedule of Procuremen of steel in consultation with Incharge as specified and conforming to specifications detailed in drawings and bills o quantities. The steel is free supply by the client to be delivered to site as per approved indent of the contractor to agreed schedule. However further all balance work to complete the reinforcement bar item shall be same as materials are supplied by the Client.

b) Receive steel and stack with covering on firm platform free of contamination.

.

c) Collect samples of each type for every batch received and test as per IS for

3.2

- Unit weight per running meter
- Cross section area
- Bend / Rebend Test
- Ultimate tensile strength
- Yield stress
- Elongation

d) Procure binding wire, cover blocks splices etc.

3.3 Prepare bar bending / cutting schedule detailing schedule covering as under and obtain approval of Incharge.

3.4

- Cutting lengths
- Laps

3.5

- Rings for various locations and items
- Chairs

Transport, cut, bend and shift to site reinforcing bars. Place in position and tie as detailed in drawing reinforcement with specified cover. Provide attendance to keep reinforcement in position during concreting. Disposal of surplus reinforcemen steel as per approval of the Incharge.

Providing required tools, plants, equipments such as

- Material cutting and bending tools
- Bending platform Bar cutting machine
- Bar bending machine
- Hydraulic clipping machines

3.6 Unit weights payable per metre shall be as follows-

1. 6mm : 0.22 kg/Rmt
2. 8 mm : 0.40 kg/Rmt
3. 10 mm: 0.62 kg/Rmt
4. 12 mm: 0.89 kg/Rmt
5. 16 mm: 1.58 kg/Rmt
6. 18 mm : 2.00 kg/Rmt
7. 20 mm : 2.47 kg/Rmt
8. 22 mm : 2.98 kg/Rmt
9. 25 mm : 3.85 kg/Rmt
10. 28 mm : 4.83 kg/Rmt
11. 32 mm : 6.31 kg/Rmt
12. 36 mm : 7.99 kg/Rmt

13. 40 mm : 9.85 kg/Rmt

3.7 WORKMANSHIP

Fabrication of reinforcement

3.8 Reinforcement shall be fabricated as per the drawing and approved bar bending schedule. Bending shall be done mechanically or with hand but to the correct radius, with proper tools and platform and shall conform to IS 2502. Bending of material shall be cold bending only. Material shall be inspected

4.0 for visible defects such as cracks, brittle, excessive rust, loose mill scale, etc. Cracked ends of bars shall not be used in Works.

4.1 Also the bars should be free from any deleterious material and hence the best practice shall be to hose down reinforcement

4.2 just prior to concreting.

It is important that bending, straightening, cutting, etc. shall be carried out in a manner not injurious to the material and the safety of the persons working should be ensured.

Anchoring

Anchoring of bars and stirrup shall be provided exactly as detailed in the structural drawing or as directed by the Incharge.

4.3 Lapping of bar

Laps shall be strictly as per the drawing or as directed by the Incharge. For general guidance, the following principles shall be followed as given in IS 456.

a) Splices shall be provided as far as possible away from sections of maximum stress and be staggered.

b) Not more than half of the total bars shall be spliced at a section.

c) Where more than one half of the bars are spliced at a section or where splices are made at points of maximum stress, special precautions shall be taken, such as increasing the length of lapand/or using spirals or closely spaced stirrups around the length of the splice.

d) Lap splices shall not be used for bars larger than 36 mm diameter: For larger diameters, bars may be welded. In cases where welding is not practical, lapping of bars larger than 36 mm diameter may be permitted and additional spirals should be

provided around the lapped bars.

4.4 e) Lap length including anchorage value of hooks in flexura tension shall be Ld (as defined in 25.2,1 of IS 456) or 5(diawhichever is greater.

f) When splicing of welded wire fabric is to be carried out lap splices of wires shall be made so that the overlap measured between the extreme cross wires shall be not less than the spacing of cross wires plus 10 cm.

Spacing of bars

Bars shall be placed in position as shown in the drawing Following guidelines as given in IS 456 shall be followed in case of difficulties or shall be carried out as directed by the Incharge.

a) Horizontal distance between two parallel main reinforcing bars shall usually not be less than the greatest of the following:

1. The diameter of the bar, if the diameters are equal.

2. The diameter of larger bar, if the diameters are unequal, and

3. 5 mm more than the nominal maximum size o coarse aggregate (By using reduced size of aggregate in congested reinforced area, conditions given hereo should be overcome).

b) Greater horizontal distance should be provided. But when needle vibrators are used, distance between bars of a group may be reduced to two-thirds of the nomina maximum size of the coarse aggregate, provided sufficient space is left between groups of bars to enable the vibrator to be immersed.

c) Where there are two or more rows of bars, the bars shal be vertically in line and the minimum vertical distance between the bars shall be 15 mm, two-thirds the nomina maximum size of the aggregate or the maxim size of bar whichever is more.

4.5 Cover to reinforcement

Reinforcement shall have concrete cover and the thickness o

such cover (exclusive of plaster or other decorative finish) shal be as specified in drawing or as directed by the Incharge. The following guidelines are to be observed in the absence of the above.

a) At each end of the reinforcing bar, not less than 25 mm, nor less thantwice the diameter of such bar;

b) For a longitudinal bar in a column, not less than 40 mm nor less than the diameter of such bar. In the case o columns of minimum dimension of 200mm or under, whose reinforcing bars do not exceed 12 mm, a cover of 25 mm.

c) For longitudinal reinforcing bar in beam, not less than 25 mm, nor less than the diameter of such bar.

d) For tensile, compressive, shear or other reinforcement in slab, not less than 15 mm, nor less than the diameter o such bar; and

e) For any other reinforcement, not less than 15 mm, nor less than the diameter of such bar.

f) Increased thickness shall be provided in case the concrete members are in the surrounding of harmful chemicals saline atmosphere, etc. and the cover shall be 50 mm or more as directed by the Incharge.

g) For concrete members totally immersed in sea water, the cover shall be 40 mm more than specified above (a) to (f).This shall be 50 mm more for periodical immersion in seawater.

h h) Concrete cover should not exceed 75 mm in any case.Cover to reinforcement shall be as specified in the drawing or as directed by the Incharge.

Details given in sub para (a) to (h) are for guidance and shall be followed in absence of any specific direction.

Welded joints or mechanical connections

4.6

A) Welded joints or mechanical connections in reinforcemen may be used but in all cases of important connections, tests

shall be made to prove that the joints are of the full strength o the connected bars. Welding of reinforcement shall be done in accordance with IS recommendation. Welded joints shal preferably be located at points where steel will not be subject to more than 75 percent of the maximum permissible stresses and welds so staggered that, at any one section, not more than 33 percent of the rods are welded.

B) Welding rods used shall conform to IS 814 : covered electrodes for metal arc welding of structural steel. Work shal be carried out by a competent welder. Samples from work site shall be taken at regular intervals and tested. Frequency and number of samples shall be as directed by the Incharge.

4.7 Fixing in position

4.7.1 Correctly cut and bent bars shall be accurately placed In position as detailed in the drawing. Unless otherwise specified by the Incharge, reinforcement shall be positioned within the tolerance as under:

a) for effective depth 200 mm or less, +10 mm

b) for effective depth more than 200 mm, +15 mm

4.7.2 But in no case shall the cover be reduced by more than 5 mm o that specified. There shall be no compromise on cover for foundation work.

4.7.3 Reinforcing bars shall be held in position during the placing o concrete by use of PVC or concrete cover blocks (made of equa strength of well-cured concrete in use), steel chair spacers steel hangers, supporting wires, etc. and secured by tying with an annealed binding wire of 16 to 18 gauge as approved by the

Incharge.

4.7.4 Layer of bars shall be separated by precast concrete spacer blocks or spacer bars. Reinforcement shall be in correct position prior to start of concreting. No reinforcing bar shall be placed on freshly laid concrete for adjusting bar spacing. Care shall be taken to maintain reinforcement in position and keep it clean, throughout the period till it is embedded in the concrete.

4.7.5 For maintaining cover, pieces of broken stone or brick or wooden blocks shall not be used at any stage.

Where reinforcement bars are bent aside at construction joints and afterwards bent back into their original position, care should be taken to ensure that at no time is the radius of the bend less than 4 bar diameters in case of plain mild steel or 6 bar diameters for deformed bars. Care shall be taken when bending back bars to ensure that the concrete around is not damaged/disturbed.

MEASUREMENTS

5.0 Reinforcement shall be measured as follows:

1. Lengths of different diameters of bars actually used including authorised overlaps shall be measured nearest to a centimeter and their weight calculated.

   a) If steel is procured by the contractor, weight per metre given in table 3.9 shall be used.

   b) If material is supplied by the client free of cost on tonnage basis to the project site, per metre weight for each diameter of the bar shall be fixed by the incharge from actual stocks of steel available at site or weight per

meter given in table 3.9 shall be used.

2. Chairs and spacer bars shall not be measured and paid. Fo reconciliation purpose it will be taken into account.

3. In case of welded coupled joints, measurement for paymen shall be equivalent to the length of overlap, as per design.

4. Price build-up shall include, in addition to cost o material,

a) Cover blocks of PVC or concrete.
b) Cutting, bending, placing and fixing in position.
c) Binding wire as approved.
d) Cleaning of bars.
e) Unloading, weighing cost (to conform the weight o steel) and storing the same in proper forms an conditions on platforms.

5. In case the material is supplied by the owner free-of-cost it shall include the following in addition to 4a) to 4d above.Transportation from owner's store to work site an returning surplus material back to store.

6. For purpose of reconciliation, maximum wastage permitted shall be 3% of the actual material used (returnable t owner). Balance shall be charged at 1.5 times the actual marke rates as penalty

SECTION – III

PLASTERING WORK

1.0 INDIAN STANDARDS

Work shall be carried out as per the latest issue of Indian Standards and Code of Practices. List given hereunder is not to be considered as conclusive and is for reference and guidance only. Any discrepancies/ conflict noticed shall be directed to the In-charge /Employer for direction/approval. However as a general rule more stringent specification shall take precedence.

1. IS 383 Specification for coarse and fine aggregates for natural sources for concrete.
2. IS 412 Specifications for expanded metal steel sheets for general purposes.
3. IS 1542 Specifications for sand for plaster
4. IS 1661 Code of practice for application of cement and cement lime plaster finishes.
5. IS 2402 Code of practice for external rendered finishes
6. IS 2645 Specifications for integral cement water proofing compound
7. IS 8112 Specification for 43 grade OPC.
8. SP 27 Handbook of method of measurement of building works.

2.0 MATERIALS

2.1 Cement

2.1.1 Cement shall be ordinary Cement conforming to IS and of grade 43.

2.2 Water

2.2.1 Water used for mixing and curing shall be clean, reasonably clear and free from objectionable quantities of silt, oils, alkalis, acids, salts so as not to weaken mortar.

2.2.2 Water tested shall be in accordance with IS 3025. Maximum permissible limits of deleterious materials in water as given in IS 456 are reproduced for ready reference in table 1 of IS 456.

2.3 Sand (coarse sand FM above 2.25 & Fine sand F M more than 1.25) shall conform to IS 1542 specification for sand for plaster. For white or coloured renderings, only quartz or silica sand shall e used. For textured finishes produced by treatment of freshly applied final or finishing coat with a tool coarser, particles used shall be screened through 3.35 mm IS sieve or 2.36 mm IS sieve. For torn texture a slightly larger portion of material coarser than 4.75 mm IS sieve shall be used.

2.4 Aggregate shall conform to IS 383.

2.5.1 Integral water proofing compound shall conform to IS 2645 (specification for integral water proofing compound).

2.6 GI Chicken Mesh

GI Chicken mesh of 20 gauge as approved shall be used over junctions of concrete and masonry or two dissimilar materials about 150mm wide fixed with GI wire nails etc. as directed by the Incharge.

Precaution - Any cracks which appear in the surface and all portions which sound hollow when lapped, or are found to be soft or otherwise defective, shall be cut out in rectangular shape and redone as directed by the engineer.

i) When ceiling plaster is done, it shall be finished to chamfered edge at an angle at its junction with a suitably tool when plaster is being done. Similarly when the wall plaster is being done, it shall be kept separate from the ceiling plaster by a thin straight groove not deeper than 6 mm drawn with any suitable method with the wall while the plaster is green.

ii) To prevent surface cracks appearing between junctions of column/ beam and walls, 150 mm wide chicken wire mesh should be fixed with U nails 150 mm centre to centre before plastering the junction. The plastering of walls and beam/column in one vertical plane should be carried out in one go. For providing and fixing chicken wire mesh with U nails payment shall be made separately

3. MORTARS

3.0.1 Mortars shall be prepared by mixing fine graded aggregate with cement, the lime or a combination of these in the proportion specified for respective items of work as detailed in the BOQ. Mixing or mortars shall be done by mechanical mixers only. Hand mixing may be permitted in specified cases on the written permission of the Incharge

3.0.2 Mortars shall be specified by proportion only and not by strength. Volumetric mixing shall be based on dry volumes of each ingredient. For convenience, measurement shall correspond to volume of one cement bag i.e. 0.035 cu m. Boxes shall be of size 40 x 35 x 25 cm. These shall be marked as mortar mixing boxes by red paint and shall be used throughout the contract. Hand mixing or mechanical mixing proportions shall be done with the use of these boxes.

3.1 Cement mortar

3.1.1 Cement mortar shall be prepared by mixing cement and sand in specified proportions. Proportioning shall be carried out as detailed above and shall be added suitably to allow for bulkage if required. Bulkage shall be determined as specified in IS 2386 Part III. Cement and sand added to mixer shall be thoroughly mixed and water shall be added to it gradually. After addition of water the mixer shall run for a minimum of 3 minutes. The mortar mixed shall be consumed within 30 minutes of its mixing.

4.0 WORKMANSHIP

Work shall be carried out as per recommendations of code of practices IS 1661 and IS 2402.

4.1 Preparation of mortar mix

4.1.1 The material used in preparation of plastering mixes shall be measured by volume using gauge – boxes or by weight.

4.1.2 When cement is measured by weight, 1440 kg of material shall be taken equivalent to one cubic meter.

4.2 Mixing

4.2.1 Mixing shall be done mechanically. Each mortar batch shall be used within half an hour. Hand mixing if permitted as special case shall be carried out on a clean, watertight platform. The mixing operation shall be continued with addition of necessary quantity of water until a uniform appearance and consistency of mortar is obtained.

4.2.2 Cement and sand shall be mixed dry in required proportion to obtain a uniform colour and water shall then be added to get the required consistency for the plaster.

4.3 Method of plastering:

4.3.1 Surface to be plastered must be clean and free from dust, loose material, oil, grease, mortar droppings, sticking of foreign matter, traces of algae, etc. It is very important to ensure that there should not be any chance of the plaster getting debonded due to presence of materials harmful for bonding.

4.3.2 Raking out of joints is expected to be carried out along with masonry but it should be checked thoroughly so as to receive good key.

4.3.3 Walls should be sufficiently damp prior to plastering. Water from plastering mortar must not be absorbed by masonry under any condition.

4.3.4 Any unavoidable projections in masonry and concrete surfaces shall be chiseled back. Care shall be taken that surrounding surfaces are not damaged and reinforcement is not exposed.

4.3.5 Thickness of one coat should not be more than 15 mm and less than 8 mm for single coat finished plaster.

4.3.6 In case of multi coat plaster, sufficient time shall be allowed for the undercoat to harden (cured, dried and shrunk properly) before subsequent coats are applied.

4.3.7 Undercoats shall be scratched or roughened before they are fully hardened to form a mechanical key.

4.3.8 The method of application is also important and hence it is recommended that the mix be thrown on the surface rather than stuck with trowel. This increases the adhesion.

4.3.9 Independent double legged scaffolding free of masonry shall be provided. Scaffolding should be rigid, allowing free and safe movement on the platform and it should be at sufficient distance or height from the working areas. Scaffolding with railing gives more confidence to workers and improves the quality of work.

4.3.10 Actual plastering shall be undertaken only on the approval of the Incharge. Plaster work should only follow the steps mentioned below:

a. Surface must be thoroughly cleaned.

b. Plaster area must be provided with level dabs or sports allowing working and checking with 2-3 m straight edge. Depth of plaster must not be less than 8 mm at any point.

c. Required concealing services must be completed and tested.

d. No further cutting of masonry must be required.

e. Repairs carried out to masonry or concealing work must be cured and dry.

f. Surface must be sufficiently damp.

g. Plaster dabs are checked for plumb and level by the Incharge or his representative.

h. Joints, concealing and repairing areas must be covered with 20 gauge GI chicken mesh as per the Incharge's instruction.

4.3.11 Corners, external or internal, shall be finished along with final coat. It is advisable to have rounded corners.

4.3.12 Plaster shall be cured for 14 days by wet curing except in neeru finish plaster. During this period plaster shall be protected from exposure to extremes of temperature and weather.

4.3.13 Plaster shall be leveled and lined by aluminium hollow section, 2-3 m long. (This will give even and leveled surface). There shall not be more than 2 mm difference in level when checked with 3 m straight edge. It is important that enough pressing and beating is done to achieve compact filling of joints and that the area is fully compacted.

4.3.14 Finishing of plaster may be carried out with wooden float (rand has) or trowel led smooth with sheet metal trowels as specified. Care shall be taken to avoid excessive trowelling and overworking of the wooden float.

4.3.15 All corners, internal or external, shall be truly vertical or horizontal. These shall be finished with a proper template to achieve best workmanship for rounding and chamfering as specified or directed.

4.3.16 Plaster shall be cut to correct horizontal or vertical line at the end of the day or if work requires to be suspended for any reason.

4.3.17 It is advisable to limit the area of plaster to 15 sq. m. to avoid cracks due to thermal movements of dissimilar material in contact, it is advisable to provide joints treated with groove or any other detail as suggested. These joints, if not, specified shall be treated with 150 mm wide reinforcing chicken mesh (approved by the Incharge) fixed over joints by GI nails and the area plastered.

5.0 TYPE OF PLASTER

5.1 12 mm thick ordinary cement sand plaster

Single coat cement-sand plaster with cement-sand mix in proportion of 1:4 shall be carried out over the entire area as detailed above. This shall be finished just with wooden float to give the best smooth surface possible. This may be for internal or external areas. Thickness may be from 10 to 15 mm maximum or as specified in the item or drawing.

5.2 18 to 25 mm ordinary cement sand plaster

This is the same as for the 12 mm thick single coat plaster except that this shall be carried out in two coats. Maximum thickness of the undercoat shall be 12 mm and balance in the second finishing coat. All operations remain the same and are as detailed in Clause 3.0 of this section.

5.3 Cement finished plaster

This shall be carried out in the same manner as in Clause 5.1 and 5.2 of this section for specified thickness in single or double coat. Then it shall be finished uniformly over the entire area with a paste of neat cement when the plaster has just hardened and finished smooth with a steel trowel. It shall be worked over again to achieve a smooth leveled surface. Quantity of cement applied shall be about 1 kg/sqm.

5.4 Sand face plaster

5.4.1 This shall generally be carried out on the outside face and exposed area of masonry work and concrete work. It shall be of minimum 22 mm thickness and shall be in two coats (1st coat 16 mm and 2nd coat 6 mm). The coat shall be CM 1:4 (1 cement: 4 sand) mixed with water-proofing compound in proportion specified by the manufacturer by weight of cement and applied as usual and surface shall be keyed.

5.4.2 The second coat shall be applied after 7 to 10 days and shall be of CM 1:4 (1 cement : 4 sand). Mortar shall be mixed with slightly coarse sand. Mix shall be worked over with 3 m gauge or wooden float to achieve an uniform surface.

5.4.3 The surface shall be allowed to harden sufficiently for sponging operation. Sponging shall be done by dipping sponge in cement water and removing fine particles and exposing large sand particles. The movement of sponge shall be such that no parches develop nor excessive material is removed from the surface. There shall not be a difference of more than 7 mm when checked with a 2 m long straight edge.

5.5 Water proof plaster

The water proofing compound shall be mixed with dry cement in the proportion by weight as specified or recommended by the approved manufacturer of water proofing compound. Mixing should be thoroughly well integrated with cement. Addition of water must not allow any slips of mixed cement.

The mix used, in general, shall be CM 1:4 (1 cement : 4 sand) and the balance application, curing, etc. remains the same as detailed above.

6.0 MEASUREMENT

6.1 Plaster work shall be measured in square meter to the second decimal place.

6.2 Thickness of plaster shall be the average depth of plaster as specified. But if extra thickness occurs due to bad quality of bricks, stones or blocks or due to bad workmanship, the repairs or extra thickness required to be carried out shall be at the cost of contractor.

6.3 a) Grooves, pattas in continuation of large areas or plaster areas shall be considered as part of the plaster and not measured separately.

b) Ceiling plaster, including ribbed beam slab shall be measured in square meters.

c) Beams and columns in continuation of masonry shall be measured in square meter.

6.4 Jambs, sills, coves, cornices, etc. shall be a part of plaster and no separate payment shall be made towards these items.

6.5 Deduction

a) Deduction for an opening in plaster shall not be for area less than 0.5 sq. m.

b) In case the opening area is 0.5 sq m. only 50% area shall be deducted from each face.

c) In case the width of door or window frames are equal to masonry, full area of opening shall be deducted.

d) In case of openings of area above 3 sqm each deduction shall be made for opening on each face and jambs, sifts, sills shall be measured.

6.6 Plaster to ceiling and walls shall be measured separately if specified in the BOQ.

7.0 RATE

7.1 Description of item in the BOQ. unless otherwise stated, includes, wherever necessary, conveyance and delivery handling, unloading, storing, fabrication, hoisting, all labour for finishing to required shape and size, setting, fitting and fixing in position, straight cutting and waste, return of packings and other incidental charges.

7.2 Preparation of surface shall be as approved by the Incharge.

7.3 Trimming off the projections on masonry shall be included in the price.

7.4 Scaffolding and working platform shall be included in the price.

7.5 Materials as detailed and as required to complete item as specified shall be included in the price.

7.6 Curing of plaster shall be included in the price.

7.7 Cleaning of adjacent areas, windows, door frames, etc. including masonry surface in exposed masonry work, shall be included in the price.

7.8 Forming grooves for joints between beams/columns and masonry etc. shall be included in the price. Any special treatment if detailed shall be measured separately as billed in BOQ.

7.9 Providing and fixing chicken mesh at junction of R.C.C., brick work, edges, corners, chiseled and repaired brick work prior to plaster over concealed conduit, etc. shall be as directed by the Incharge. It shall be considered as part of item and no separate charge will be payable.

SECTION-IV

1.0. SPECIFICATIONS FOR GLAZED TILE FLOORING

1.1. White glazed tiles - The tiles shall be of approved make and shall generally conform to IS: 777. They shall be flat, and true to shape and free from blisters crazing, chips, welts, crawling or other imperfections detracting from their appearance. The tiles shall be tested as indicated in Appendix of IS: 777.

The tiles shall be square or rectangular of nominal size such as 150 x 150 mm, 100 x 100 mm, 100 x 200 mm or as directed by the engineer. The thickness of the tiles shall be 5 mm, or 6 mm as specified. The length of all four sides shall be measured correct to 0.1 mm and average length breadth shall not vary more than ± 0.8 mm from specified dimension. The variation of individual dimension from average value of length/breadth shall not exceed ± 0.5 mm. Tolerance in thickness shall be ± 0.4 mm.

Note 1: Where tiles of nominal sizes of 150 x 150 mm or 100 x 100 mm are not available tiles of nominal sizes 152 mm x 152 mm or 108 mm x 108 mm may be allowed to be used with prior approval of the engineer.

Note 2: The actual size of tiles supplied shall be 1 mm less so that with 1 mm joint, the tile when laid shall conform to the nominal size. The top surface of the tiles shall be glazed and glaze shall be either glossy or matt as specified. The underside of the tiles shall not have glaze on more than 5% of the area in order that the tile may adhere properly to the base. The edges of the tiles shall be preferably free from glaze. However, any glaze if unavoidable, shall be permissible on only up to 50 per cent of the surface area of the edges.

1.2. Coloured tiles - **Only the glaze shall be coloured as specified. The sizes and specifications shall be the same as for the white glazed tiles.**

1.2.1 Decorative tiles - The type and size of the decorative tiles shall be as follows

a) Decorated white black ground tiles

The size of these tiles shall be 152 x 152 x 6 mm and / or 108 x 108 x 6 mm.

ii) Decorated and having coloured back ground

The sizes of the tiles shall be 152 x 152 x 6 mm and / or 108 x 108 x 6 mm.

2.0. Preparation of surface and laying

Base concrete or the RCC slab on which the tiles are to be laid shall be cleaned, wetted and mopped. The bedding for the tile shall be with cement mortar 1:3 (1cement: 3 coarse sand) or as specified. The average thickness of the bedding shall be 10 mm while the thickness under any portion of the tiles shall not be less than 5 mm.

Mortar shall be spread, tamped and corrected to proper levels and allowed to harden sufficiently to offer a fairly rigid cushion for the tiles to be set and to enable the mason to place wooden plank across and squat on it.

Over this mortar bedding neat grey cement slurry of honey like consistency shall be spread at the rate of 3.3 kg of cement per square meter over such an area as would accommodate about twenty tiles.

Tiles shall be soaked in water washed clean and shall be fixed in this grout one after another, each tile gently being tapped with a wooden mallet till it is properly bedded and in level with the adjoining tiles. The joints shall be kept as thin as possible and in straight lines or to suit the required pattern.

The surface of the flooring during laying shall be frequently checked with a straight edge about 2 m long, so as to obtain a true surface with the required slope.

Where full size tiles cannot be fixed these shall be cut (sawn) to the required size, and their edge rubbed smooth to ensure straight and true joints.

Tiles which are fixed in the floor adjoining the wall shall enter not less than 10 mm under the plaster, skirting or dado. After tiles have been laid surplus cement slurry shall be cleaned off.

1.0. Pointing and finishing - The joints shall be cleaned off the grey cement slurry with wire / coir brush or trowel to a depth of 2 mm to 3 mm and all dust and loose mortar removed. Joints shall then be flush pointed with white cement added with pigment if required to match the colour of tiles. The floor shall then be kept wet for 7 days. After curing, the surface shall be washed and finished clean. The finished floor shall not sound hollow when tapped with a wooden mallet.

SECTION -V

SUPPLY AND INSTALLATION OF PRECOATED GALVALUME SHEET PROFILE FOR ROOFING &CLADING WITH ACCESSORIES FOR SHEDS ETC. AT GAIL (INDIA) LIMITED, USAR.

TECHNICAL SCOPE OF SUPPLY & SPECIFICATION

5.0 SPECIFICATIONS

5.1 The specification for the entire scope of supply under the order shall be in accordance with the latest IS & AS codes. Wherever these codes are silent, the same shall be governed by sound Engineering practice, and the decision of the GAIL, in matter of interpretation, shall be final and binding on the Contractor.

5.2 The Bidder must read carefully all such specifications / codes before submitting their Bid. It shall be deemed that the Bidder has thoroughly read & understood the "Scope of Work & Technical Specifications" before filling in the rates / prices, irrespective of the fact whether they have really done so or not, and no claim on this account shall be entertained at a later date.

1.1. SCOPE OF SUPPLY

The work mainly consists of Supply and installation of pre-coated Galvalume steel sheets with roofing & cladding accessories to GAIL (India) Limited, USAR.

2.1 PRECOATED ZINC ALUMINIUM SHEET ROOFING / CLADDING

2.1.1 Material

The base metal of the roofing shall be Cold Rolled Steel Sheet conforming to IS: 513. It shall be zinc aluminum coated by Hot-dip process as per AS:1397 / IS:277 / IS:14246, The bottom unexposed surface shall then be coated with alkyd backer of minimum 5 microns over a 5 micron coat a primer. Top exposed surface shall have primer of minimum 5 microns followed by SMP/ Super Polyester top coat of minimum 20 microns of specified colour.

Manufacturers of pre-coated sheets may be of the following:

i) Tata BlueScope Steel Ltd.

ii) JSW Steel Ltd.

iii) Bhushan Steel Ltd.

iv) CRIL

iv) Any other reputed brand approved by EIC

2.1.2 Properties

The pre-coated zinc aluminium steel sheets meet the following performance standards.

Pencil Hardness - Min. HB

T-Bending	-	Test 5 T
Impact Resistance	-	Min. 10J
Salt Spray Test	-	1000 Hours (Exposed top side)
QUV – Wealterometer Test	-	1000 Hours
Humidity Test	-	1000 Hours
Temperature Resistance	-	100 deg C for 24 hours
Fire Performance	-	Class-I

2.1.3 Profile

The profile shall have a depth of not less than 28mm at a pitch of not more than 255 mm (with intermediate ribs). Overall total coated thickness shall be minimum 0.50mm having base metal thickness of 0.45mm. Minimum weight (supply width) shall be 5.00Kg/SqM.

2.1.4 Accessories

All roofing accessories like ridge, corners, flashing, north light curves/ bend, and gutter, gutter pipe etc. shall be fabricated out of the approved pre-coated sheets. Details may be seen at site by the bidder. Metallic self-drilling self-tapping fasteners for fixing shall be corrosion proof meeting performance standard as per AS: 3566, Class-III having neoprene washer. Sealants shall be neutral cure type and cold setting variety.

3. All the final inspected materials should be packed properly for transportation, loading/ unloading and storage purpose min. for one year. Packing & forwarding cost shall be included with offer.

4. Hi-tensile pre-painted Zincalume/Galvalume steel sheets:

Supply & Fixing of Prepaintedcoloured Trapezoidal profiled Sheeting 1000-1020 mm cover width, 28-30 mm high crests with subtle square fluting in the five pan at nominal 190-255 mm(as approved by EIC) centre-to-centre manufactured out of 0.50 mm TCT hi-tensile prepaintedZincalume /Galvalume steel (AZ-150

gsm. Aluminium –Zinc alloy metallic coating of total both sides 550 MPa yield stress as per AS-1397). Colour/ Exterior coat of SMP (Silicon Modified Polyester) / BHP XRW paint system, 20 micron top coat applied over 5 micron primer and a 5 micron polyester back coat applied over 5 microns primer OR equivalent coating/painting. The sheet shall have wide pans with stiffening ribs for effective water shedding and special male/female ends with full return legs on side laps for purlin support. The male end of the sheet shall have anti-capillary flute at side laps to prevent leakages. The sheet shall be fixed by means of Galvanised self-drilling selftapping fasteners (12-14x55 with EPDM seals). The sheet shall be supplied in lengths maximum upto 6-12 meter long to suit site dimensions. The scope includes all sealing of joint, curves, edges or other accessories with silicon sealant.

a) The bidder may consider CLIPLOCK system instead of self-drilling screw system without any change in specification, rates and terms and conditions of the work.

b) 0.50 mm thick TCT (Total Coated Thickness) / 0.45 BMT (Base Metal Thickness) precoated sheet of make "TATA BlueScope", "Lloyd" ,Interacrh or equivalent confirming with minimum tensile strength 550 MPa confirming AS : 1397. The sheet should pass 1000 hour salt test as per relevant test.

5. Supply & Fixing of Pre-painted coloured Trapezoidal profiled / PLAIN/ CURVED & PROFILED sheeting in ridges, curved surface, North light Curve, louver, cornors, Apron Piece, Gutter, Gutter pipe etc. manufactured out of 0.50 mm TCT hi-tensile pre-painted Zincalume /Galvalume steel (AZ-150 gsm. Aluminium –Zinc alloy metallic coating of total both sides 550 MPa yield stress as per AS-1397). Colour / Exterior coat of SMP (Silicon Modified Polyester) / BHP XRW paint system, 20 micron top coat applied over 5 micron primer and a 5 micron polyester back coat applied over 5 micron primer OR equivalent coating/painting. The sheet shall be fixed by means of Galvanised self-drilling selftapping fasteners (12-14x55 with EPDM seals). The sheet shall be supplied in lengths maximum upto 6-12 Mtrs long to suit site dimensions. The scope includes

all sealing of joint, curves, replacing louvered, edges or other accessories with silicon sealant. The bidder may consider CLIPLOCK system instead of self-drilling screw system without any change in specification, rates and terms and conditions of the work. Refer drawing no-1.

a) The bidder may consider CLIPLOCK system instead of self-drilling screw system without any change in specification, rates and terms and conditions of the work. The work is to be carried out directly as per specifications and direction of engineer-in-charge and the manufacturer.

b) 0.50 mm thick TCT (Total Coated Thickness) / 0.45 BMT (Base Metal Thickness) precoated sheet of make "TATA BlueScope", "Lloyd" ,Interacrh or equivalent confirming with minimum tensile strength 550 MPa confirming AS :1397 The sheet should pass 1000 hour salt test as per relevant test.

6. Non-asbestos sheet: Providing non-asbestos high impact Polypropylene reinforced cement 6mm thick corrugated sheets (as per IS: 14871) roofing up to any pitch and fixing with polymer coated J, or L hooks, bolts and nuts 8mm dia. G.I. plain and bitumen washers or with self-drilling fastener and EPDM washers etc. complete (excluding the cost of purlins, rafters and trusses), including cutting sheets to size and shape wherever required. The scope includes all sealing of joint, curves, edges or other accessories.

7. Paint: Supplying and Applying of Paint on structural steel work like roof trusses, steel column, frame, top chord, web, lateral bracing, truss plate, strut, purlins, bottom chord bracings with supply of all materials, manpower, tools & tackles, scaffolding etc. at any height. Paint system includes surface preparation + F 8 (self-priming type, surface tolerant high build epoxy coating as per EIL spec. code) full one coat of 100 microns + F 6A (Epoxy high build finish coating; EIL spec code) full one coat of 100 micron + F 2 Page 4 of 6 (Acrylic Polyurethane Finish Paint; EIL spec. code) two coats, each 35 micron (Total DFT 270 micron on average)including scraping/cleaning old surfaces and surface preparation by brass chipping / Wire brush/ Emery paper/whipping by dry/wet cloth or

combination of above to the entire satisfaction of EIC. (30% of plan area for roof will be measured for payment purpose.)

8. SKYLIGHT (POLYCARBONATE SHEETS): Supply and installation of 2 mm thick clear embossed polycarbonate sheet (polycarbonate profile to match with standing seam profile) with side laps to be clamped with galvalume sheets of 0.55mm (tct), which can be further seamed with metal roof sheets. Product required is clear embossed with both side UV stabilizer, having at least 60-80% transparency, conforming to the relevant IS code including cutting to shape and size as required including necessary sealants (silicon sealants/butyl sealants for transverse laps).

9. Turbo Ventilator: Supplying, fixing and installation of dia 600 mm Wind driven Turbo Ventilator on pre-coated trapezoidal sheet with FRP base of Devasish, Airier, Sudha or equivalent make. The rates are inclusive of all related works including sealing of opening and making it leak proof and finishing to match with existing roof. All as per manufacturers specifications and as directed by the Engineer in charge.

10. SAMPLES FOR APPROVAL

The contractor shall furnish to the Engineer-In-Charge for approval of samples of all material to be used in the item/work. Such samples shall be submitted before item/work is commenced in advance. Profile of ridges, curved surface, North light Curve, louver, cornors, Apron Piece, Gutter, Gutter pipe is to be decided by EIC. It is the responsibility of the contractor to arrange for tests as required by Engineer-In-Charge at his own cost. The material representing approved samples shall only be used for the construction and installation. Contractor shall procure materials as indicated in list of approved makes (if given) / or materials with ISI certification may also be used after approval of EIC.

10.1 TESTS / INSPECTION:

Contractor has to make all the arrangements for tests / inspection either at site or elsewhere at his own cost and expenses. Also necessary laboratory tests may be

carried out at his own cost and expenses. However, contractor must use ISI marked materials or materials of listed approved make, wherever required. Contractor shall arrange necessary test as per standard practice and decided by EIC for the materials used for the work. However, the contractor has also submitted the test certificate of material provided by manufacturer.

11. The rate also includes testing of samples of various materials (field or laboratory) and transportation of the materials at site including applicable VAT, all taxes & duties etc., loading & unloading etc**.**

12. Any other requirement which is not covered in the scope of supply but necessary to complete the supply and work are to be complied by the bidder with the coated rates.

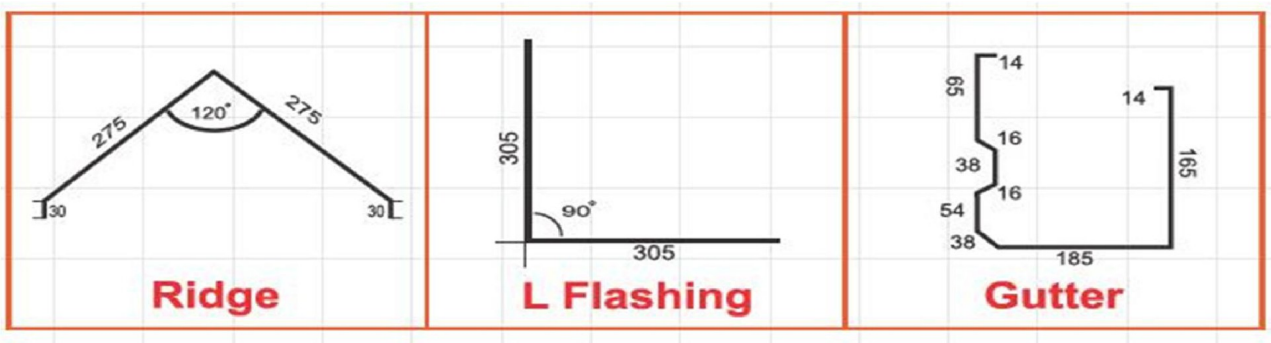
13. Bidder may visit the site of works before quoting his rates / prices for correct assessment of work.

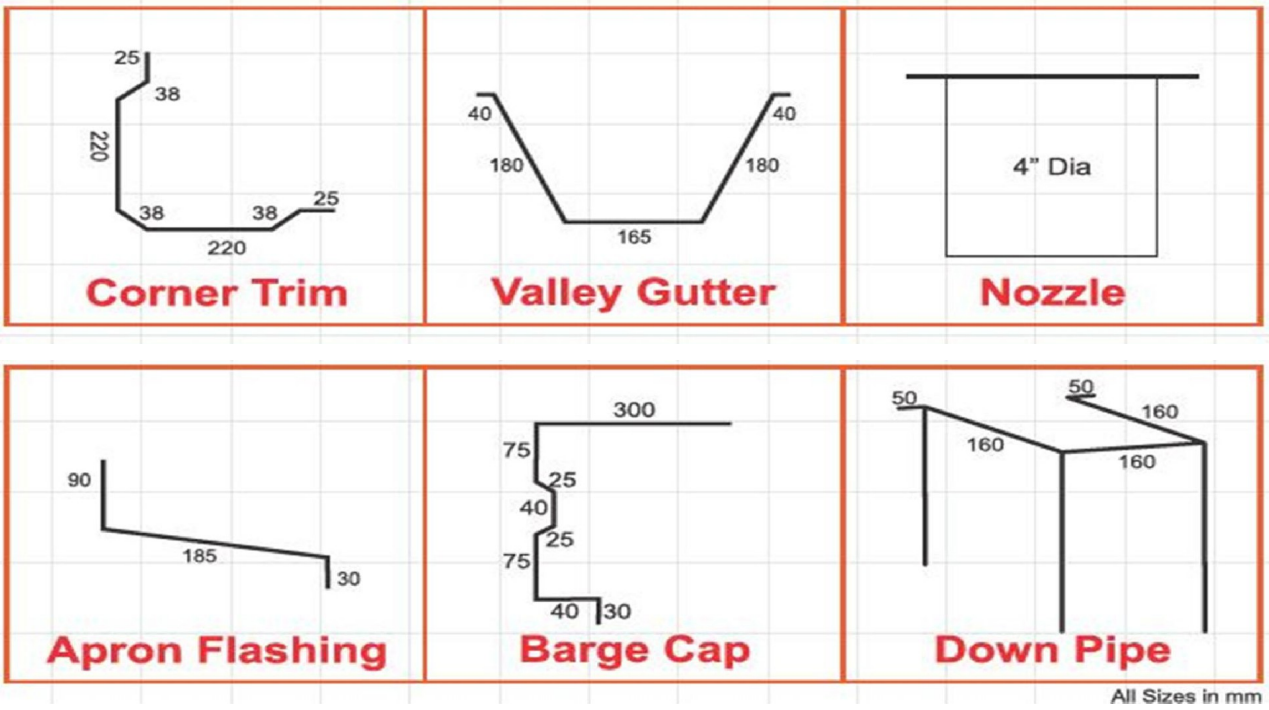
14. Length of the sheets & roofing accessories should be 1.5m, 2.0m, 3.0m, 4.0m, 5.0m, 6.0m or as per direction of GAIL. However, bidder may assess the app. Qty of all sizes by visiting the site before submitting the offer.

15. Colour of the sheets shall be finalized by GAIL. Bidder has to supply the materials exactly as per colour suggested by GAIL.

Party has to supply the materials in quantity as per order. However, quantities of different sizes may be varying as per requirement of GAIL.

DIAGRAM-1





GAIL (INDIA) LIMITED, USAR
REPLACEMENT OF AC SHEET WITH PRECOATEDSHEETS AT GAIL, USAR.

Note : All diagram and dimension are for indicative purpose. Final decision regarding profile and dimension of roofing accessories will be taken by EIC and bound to contractor.